LESSON PLANS INTEGRATING ART WITH STEAM: PROVIDING STUDENTS WITH UNIVERSAL EDUCATION EXPERIENCE

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LESSON PLANS INTEGRATING ART WITH STEAM: PROVIDING STUDENTS WITH UNIVERSAL EDUCATION EXPERIENCE

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ABSTRACT

With funding being cut in public schools, many students are no longer being exposed to the arts. Studies have shown that integrating art with math and science leads to a more successful student. As an alternative to classroom instruction, museum education can be used to not only develop art skills, but can also assimilate those skills into math, science, and engineering. As an intern at the Columbus Museum in Columbus, Georgia, I developed lesson plans for teachers to use in the classroom. Alternatively, students may come to the museum to participate in the activities. The lesson plans will be presented in the spring of 2018 at an event for local teachers. By bridging the gap between schools and the museum, these plans allow students to benefit from art as well as science, math, and technology.

INDEX WORDS: Georgia, Public Education, Museum Education, Georgia Standards of Excellence, Lesson Plans, Art, Art Education, The Columbus Museum, Columbus Georgia, STEAM, STEM.

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FORWARD

This paper was written as an alternative to thesis to fulfill my Honors College requirements. It was developed in conjunction with the Education Department at the Columbus Museum during an internship and consists of lesson plans that will ultimately be used for teachers in Muscogee County to assist them in meeting the Georgia Standards of Excellence.

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American museums are visited approximately 850 million times a year according to the American Alliance of Museums (AAM). This is more than the attendance at all major league sporting events and theme parks combined. School groups constitute about 55 million of those total visits, with museums spending $2 billion on educational programs. Museums generate about $21 billion into to the economy every year as well.[1] The AAM also states, "Children who visited a museum during kindergarten had achieved higher scores in reading, mathematics, and science in third grade than children who did not. This benefit is also seen in the subgroup of children who are most at risk for deficits and delays in achievement." The idea of providing an alternative source of art education developed while working on lesson plans for the Girls Scouts to utilize in completion of their badges. Badge requirements were applied in the same way that school standards are applied. These lessons provide an alternative for students to develop their skills outside the classroom. There is no doubt that art education engages student development in many areas, and museums are a key to that education.

THE FOUR C'S

According to the National Education Association (NEA), there are four skills that are most important for K-12 education. These skills, also known as the "Four Cs", are as follows: creativity, critical thinking, communication, and collaboration. The Four Cs are a part of the NEA's "21st Century Skills" program, which created a framework of 18 different skills that students need to succeed in the 21st century. Because that original

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[1] American Alliance of Museums, Aam-us.org. http://www.aam-us.org/about-museums/museum-facts.

framework was extensive and complicated, the program was revised and consolidated into the Four Cs.[3]

Creativity

Learning how to tap into their creativity allows students to enhance their lives, but is often restricted to visual arts. Educators should view creativity as an integral component of all disciplines, perhaps using art as a springboard for development, rather than an isolated discipline.[4] Painting, sculpting, drawing, and other art-centered activities allow student's creativity to blossom. Creativity skills can go beyond art to include problem solving, writing, critical thinking, math and science. Sketching and sculpting encourages young artists to learn problem solving and critical thinking skills as they create. Decisions about their compositions and the need to plan and develop multiple ideas and creations before making their final decision aids in the development of cognitive skills. As with any skill, children who practice creativity when they are young will have a better chance of harnessing it as adults. As they grow older, these skills will be necessary in both higher education and their chosen careers.[5] By encouraging students to think deeper and more thoughtfully during the creative process, educators allow them to enter a setting where they are free to explore, reason, and even develop conflicting viewpoints.[6]

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[3] "An Educator's Guide to the "Four Cs"," NEA.org

[4] Kelly W. Guyotte, Nicola W. Sochacka, Tracie E. Costantino, Nadia N. Kellam, and Joachim Walther, "Collaborative Creativity in STEAM: Narratives of Art Education Students' Experiences in Transdisciplinary Spaces," International Journal Of Education & The Arts 16, no. 15: ERIC

[5] Valerie Strauss, "Top 10 Skills Children Learn from the Arts," The Washington Post. January 22, 2013.

[6] Kelly W. Guyotte, "Collaborative Creativity in STEAM: Narratives of Art Education Students' Experiences in Transdisciplinary Spaces."

Critical Thinking

Some researchers consider "all problems to be a piece of art because the ideas people come up with to solve the problem require similar patterns and methods of thinking."[7] When looking at art it is important to ask "why?" Students can develop their critical thinking skills by answering questions such as, "Why did the artist use these colors," "What was the artists thinking of when they created this," and "Why did the artist create this?"[8] They can develop their own speculations or research the piece and find out what other art historians have written. Even museum educators can see pieces they have studied for months in a different light as they listen to the interpretations through the fresh eyes of the students.

Perseverance is another skill that is learned through creating art. It is not likely that a student's first sketch will look like the *Mona Lisa*. However, as the drawing develops and skills improve, children will begin to grasp a long-term view of the work. Students develop critical thinking skills as they make changes and improve their art work. Understanding the idea that "practice makes perfect" assists the students in learning the importance of not giving up. With every doodle, the *Mona Lisa* is one step closer.[9]

Today's society is diverse in cultures, people, and ideas. Studying art is an effective avenue for students to learn about the different cultures in our country and

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[7] Kelly W. Guyotte, Nicki W. Sochacka, Tracie E. Costantino, Joachim Walther, and Nadia N. Kellam. "STEAM as Social Practice: Cultivating Creativity in Transdisciplinary Spaces." Art Education 67, no. 6: 12-19. Education Full Text (H.W. Wilson), EBSCOhost. 2014.

[8] Charlina Stewart,"Early Art: What it Means and How to Encourage It," PBS. May 25, 2012.

[9] Valerie Strauss, "Top 10 Skills Children Learn from the Arts," The Washington Post. January 22, 2013.

around the world. Art often directly relates to the culture that created it. For example, lessons about Japanese pottery teaches children the practice of tea ceremonies and their reflection of the culture's values, history and traditions. Children become more open minded and cognizant of other cultures and their importance in our diverse society.[10]

Communication

Through art, children can also learn how to express themselves. Non-verbal communication is an important part of art history, as many artists are not available to explain the thoughts behind their creations. Creating their own art to express their feelings and thoughts through colors and shapes, instead of words, may be a much-needed outlet for students. By studying art, they can also learn specific symbols and ideas that are used throughout art history to express things such as love or hate. Recognizing this in others' work leads to a better understanding of those pieces and facilitates incorporation of these ideas into their own work.

Collaboration

Working with others is a valuable skill. Collaborative creativity is described as "an act of shared creation and/or shared discovery: two or more individuals with complementary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own."[11] Allowing brainstorming to create collaborative works, or even critiquing each other's work develops these analytical skills in students. Teachers in STEAM studies stated that providing opportunities, such as

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[10] Grace Hwang Lynch, "The Importance of Art in Child Development," PBS. May 25, 2012.

[11] Kelly W. Guyotte, "Collaborative Creativity in STEAM: Narratives of Art Education Students' Experiences in Transdisciplinary Spaces."

critiques, for their students to learn collaboration skills helped them to collaborate more effectively in other projects.[12] By collaborating with others, students develop their listening, speaking, and critical thinking skills. For younger students, this allows them to practice sharing ideas and thoughts. Collaboration and communication with others is important not only in their education, but in their personal lives. Previous examples are added to by utilizing verbal communication skills such as including a discussion of ideas or criticism in the proper manner as a necessary element to education. Art-centered classes often call for formal critiques requiring students to break down larger ideas into parts and develop ideas about why things were done a certain way. This same technique may be used in science, math and English classes. Unsurprisingly, all four skills are mentioned previously in this paper as abilities that students can develop through creating and learning about art and art history. Because math and science tend to be more valued than art, much of the funding for fine arts has been eliminated and schools find themselves without art and music programs. By demonstrating how to combine art with other subjects, educators are still able to meet school standards while students are getting the benefits and the Four Cs from the arts.

STEAM

Incorporating art with math and science may be a solution to the reduction in art classes in schools and is a strategy known as STEAM. Fields related to science, technology, engineering, and math are collectively known as STEM fields, and educational programs that add the arts are referred to as STEAM. The objectives of

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[12] Cassie F. Quigley, and Dani Herro. "Finding the Joy in the Unknown": Implementation of STEAM Teaching Practices in Middle School Science and Math Classrooms," Journal Of Science Education And Technology 25, no. 3: 410-426. ERIC, EBSCOhost. 2016.

STEAM are to "transform research policy to place art and design at the center of STEM, encourage integration of art and design in K-20 education, and to influence employers to hire artists and designers to drive innovation."[13] The concept originates from the Rhode Island School of Design (RISD), but is now being used by educators all over the world.

Charles Nègre, a photographer from the 1880's, said, "Where science ends, art begins. When the chemist has prepared the sheet, the artist directs the lens."[14] This quote is a perfect example of how STEM can become STEAM. Science, technology, math and engineering are all involved when creating a camera. Science is used when different chemicals mixed together to develop the film, but an artist shoots the photographs that will appear on the paper in the dark room. The artist set up the shots, discovered the perfect lighting, and caused the shutter to close at the exact right moment. Without science, there is no means to take a photograph, but without the artist there is no photograph.

While many may think of art as a strictly individual endeavor, when integrated with STEM, the traditional, separate courses are converted to collaborative workspaces. STEM challenges educators to think of their subjects as intentionally integrated with one another rather than as separate, exclusive ones. The knowledge and experiences gained in one area can aid in understanding of another. [15] By taking classes that are typically taught separately, and integrating them into a multidisciplinary curriculum that includes art,

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[13] "Case Studies," STEM to STEAM, http://stemtosteam.org/case-studies/.
[14] Ibid.
[15] Kelly W. Guyotte, Nicola W. Sochacka, Tracie E. Costantino, Nadia N. Kellam, and Joachim Walther, "Collaborative Creativity in STEAM: Narratives of Art Education Students' Experiences in Transdisciplinary Spaces," International Journal Of Education & The Arts 16, no. 15.

schools and students begin to work collaboratively to simulate a more realistic environment. By looking at STEM beyond the classroom, we view it as a device to promote economic growth and international competitiveness through collaboration. To bring this to the educational setting, this requires educators to integrate courses that were previously taught in isolation and modify them to create an interdisciplinary curriculum.[16]

A Conduit to Success

Currently, research shows that exposure to the arts at a young age has increased the number of patents generated and businesses owned. A research team from Michigan State University studied Honors College graduates from 1990-95 that majored in STEM courses. The team discovered that graduates who generated patents or owned their own businesses "received up to 8 times more exposure to the arts as children than the general public."[17] However, these graduates were not just introduced to the arts as children; they sustained involvement throughout their adult years as well. The research team found this continuous engagement to be a very important and surprising factor of their study. Those graduates who maintain an interest in and involvement in the arts were more likely to become an inventor.[18]

The researchers state that activities such as the arts give children a chance to explore out-of-the-box thinking. The graduates even reported the usefulness of "artistic

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[16] Kelly W. Guyotte,, Nicki W. Sochacka, Tracie E. Costantino, Joachim Walther, and Nadia N. Kellam, "STEAM as Social Practice: Cultivating Creativity in Transdisciplinary Spaces."

[17] Rex Lamore, Robert Root-Bernstein, Michele Root-Bernstein, John H. Schweitzer, James L. Lawton, Eileen Roraback, Amber Peruski, Megan Vandyke, and Laleah Fernandez. "Arts and Crafts Critical to Economic Innovation." Economic Development Quarterly27, no. 3 (2013): 221-29.

[18] Ibid.

skills – such as analogies, playing, intuition and imagination – to solve complex problems."[19] In fact, one of the researchers states that innovators like these are what the economy needs to create high-growth and high-paying jobs. Educators are encouraged by the researchers to find a way to support endeavors in science, math, and artistic ventures in order to have graduates with similar outcomes.[20] Programs like STEAM help to facilitate and improve outcomes, particularly if incorporated in all levels of all education. As the research suggests, students benefit in all areas of study from prolonged involvement in the arts.

Research shows that STEAM teaching "increases motivation, engagement, and effective disciplinary learning in STEM."[21] "Fifteen-year old American students tested at 28% math literacy and 24% science literacy on a global scale,"[22] but STEAM programs have been proven to increase student achievement in science and math.[23]

Funding the Arts

Despite these findings, funding for the arts have been cut in over 80% of school districts in the United States since 2008,[24] and many high schools no longer offer art history courses.[25] Due to the reduction in available art education, it is important to have

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[19] ibid.
[20] ibid.
[21] Cassie F. Quigley, and Dani Herro. "Finding the Joy in the Unknown": Implementation of STEAM Teaching Practices in Middle School Science and Math Classrooms,"
[22] Toni Wynn, and Juliette Harris, "Toward a STEM + Arts Curriculum: Creating the Teacher Team." Art Education 65, no. 5: 42-47, Education Full Text (H.W. Wilson), EBSCOhost, 2012.
[23] Cassie F. Quigley, and Dani Herro. "Finding the Joy in the Unknown": Implementation of STEAM Teaching Practices in Middle School Science and Math Classrooms."
[24] Stacey Boyd, "Extracurriculars Are Central to Learning," U.S. News & World Report, April 28, 2014.
[25] Don Beetham, "Why Art History," Rutgers School of Arts and Sciences. http://arthistory.rutgers.edu/menu-ii/academica/why-art-history.

an alternative means of learning for these children such as the opportunities provided by an art museum. Funding cuts mean that there is no money for specialized art teachers, and typical school teachers may not be knowledgeable in this area. The solution is local art museums, which have skilled instructors available to the students, often at no cost. John Dewey, one of the fathers of educational reform, recognized "that museums were educational institutions for learning many disciplines and envisioned museums as integral components of the reformed school."[26] Students can visit art museums on field trips, on their own, through special events, and museum educators can even bring the resources of the museum into the classrooms.

ALTERNATIVES TO THE TRADITIONAL CLASSROOM

Museums focusing only on tours may see that individuals are not interested because they do have any interest in simply viewing artwork. The museum experience becomes more valuable and meaningful when the visitor experiences and interprets art in their own terms. Research suggests that people have a more significant experience if they can interact on a personal level with the items on display. While visitors on a tour may glean basic facts about the artwork or artist, a deeper appreciate is gained if they are invited to understand it through some activity. Additionally, if students and visitors extrapolate their own views of the art pieces, rather than simply being told what someone else has already decided that the piece means, they are more likely to appreciate the museum experience. By specifically tying each of the lesson plans to works of art at the Columbus Museum, the educators have overcome this challenge. Allowing the students

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[26] George E. Hein, *Progressive Museum Practice: John Dewey and Democracy*, Walnut Creek, Calif: Routledge, 2012.

to visit the museum and view the artwork allows the student to develop their own unique insight and interpretation of the pieces.[27]

Educator Evening

At the Columbus Museum in Columbus, Georgia, the education department is taking STEAM to teachers in the local community. In conjunction with my museum internship, I was tasked by Christy Barlow, Academic Programs Manager of the Columbus Museum, to develop lesson plans that integrate art projects with Georgia school standards. The lessons are developed using the Georgia Standards of Excellence and the Alabama Course of Study Standards and include prior and post-activity questions, instructions and goals of the activity, and examples of related artwork from the Columbus Museum. To begin this project, I spent my semester-long internship reviewing over 200 Georgia School Standards and selecting those standards that would be both adaptable and pragmatic for the teachers. The museum requires that the plans be ready for the teachers to use, but flexible enough so that they can be adapted to individual classroom needs. For example, a 1st grade math standard might be met by adding 1+1, but using the same lesson plan, an 8th grade standard might be met by dividing 125 by 9. Specific examples of how to adapt the plans will be given as each lesson plan is described. The plans include step-by-step instructions; however, they were intentionally developed without a "say this, now say this" format because teachers are experts on the teaching style that works best for their students. The majority of the students who visit

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[27] David Anderson, Alex De Cosson, and Lisa McIntosh, *Research Informing the Practice of Museum Educators: Diverse Audiences, Challenging Topics, and Reflective Praxis*. Rotterdam: Sense Publishers, 2015, 232-233.

the Columbus Museum are elementary age (grades 1-5), so I began by focusing on those standards and how they could be integrated into art-based lesson plans.

These lesson plans will be presented to the visiting Muscogee County teachers at the Columbus Museum's Educator Evening in March. My lesson plans will be the feature of this year's event. Four stations will be prepared in which I, along with the museum staff, will demonstrate each art activity while presenting the methods used to complete each project. The teachers will then be able to take a copy of the lesson plans, along with the sample they created, back to their classroom. A STEAM program that was presented in 2015 was so successful that many teachers have asked for additional lesson plans in this area. This is evidence that these programs are working in the classroom, and that teachers find them advantageous for their students.

The lesson plans include modifications that allow them to be used in numerous grades from K-12. Some modifications are as simple as changing math equations, while others allow the older students to use more complex techniques or technology. No matter the grade level, the students' work will relate to art pieces in the Columbus Museum featuring pieces from area artists. To encourage the teachers to utilize the plans, my goal is to develop ready-to-use plans that will save the teacher time in their busy schedules.

The lessons include not only an art activity, but also questions and discussion that will aid in the students' understanding of art in general. Vocabulary, such as that from the principles and elements of art, will be incorporated as well as an opportunity to practice the terms correctly when discussing their own and their classmates' work. For example, instead of saying simply, "I like how all your colors look together," students will be guided to use the new vocabulary by saying things such as, "I like the way your use of

repeated warm colors created harmony within your composition." By teaching them to be specific and detailed when describing ideas, this will add not only to their vocabulary, but to their communication skills as well.

Learning about the type of art, pieces, and artists is an integral part of the lessons. Because most of the pieces in the Columbus Museum are from the local area, students have a unique opportunity to learn about art that directly relates to where they live. A discussion of the history behind the art that they are creating coupled with viewing actual, local examples of it, will provide the students with a concrete beginning to an abstract subject. For example, when creating their *Color by Numbers* (Lesson Plan 1), they are re-creating a portrait by Amy Sherald, a Columbus native. Not only will they be practicing math equations to discover what color they need to use, but they will also learn about portraits, color, composition, abstraction, and the artist.

Lesson Plan: Color by Number

The first lesson plan, mentioned above and shown in detail in appendix A, is *Color by Number*. For this lesson students will solve math equations to reveal a painting found in the Columbus Museum. This is done by pixelating a work of art using Photoshop into an 8 x 8 grid of squares. Each color is then assigned a number. For example, every green square may be assigned the number 9 and every red square will be 3. Next, equations are created that will equal those numbers and be written in the corresponding blank square on a blank grid. As students solve the equations, they will determine what color needs to go in that square and once the squares are completed, it should resemble a pixelated version of the painting. For younger students such as 1st graders, the equations will be simple like "1+1 = __" but as they get older, the equations

be more difficult. The younger students will be creating abstract pieces that resemble Alma Thomas' painting *Air View of Spring Nursery.* This painting was selected so that if the equations are not all entirely correct, their pieces will be recognizable. For the High School students, the painting *What's Different About Alice Is That She Has the Most Incisive Way of Telling the Truth* by Amy Sherald will be used.

Amy Sherald, a Columbus, Georgia native, is known for her gray-toned portraits. When she paints a portrait, Sherald constructs a new identity for the person using clothing and objects they wear. She wants people to view her portraits and "imagine life outside the circumscribed stereotype" and "see that a more beautiful world exists beyond the confines of your environment." She was commissioned this year to create a portrait for former first lady, Michelle Obama.[28]

Captivating the interest of the students is key, and by basing the older student's grids on a portrait instead of an abstract artwork, they remain engaged for the duration of the project to see what develops. The grids can be much larger and the equations can be concepts learned throughout the year to make a more complex, intense project that could extend throughout the school term. Flexibility in design allows for short lessons to utilize a few minutes each day while longer lessons are designed to engage the students for an entire class period, all depending on teacher preference and student age level.

Equations are used to meet math standards as well as basic visual art standards based on 2D art for all grades 1-12. This gives students a chance to practice math skills in conjunction with the Four C's by using a creative process with a visual, tangible result.

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[28] "Search the Collection," The Columbus Museum, http://www.columbusmuseum.com/collections/search/.

Students who are less interested in mathematics are now provided with an opportunity to be creative in a unique way. Critical thinking skills are also involved when they perhaps notice their colored squares do not match up with a classmate's or if the picture does not seem to be developing properly. Once the piece is finished, the students can discuss the process and the art piece itself to sharpen their communication skills. Adding math into the process transforms this project from art into STEAM. This lesson covers over 30 visual art standards and over 20 math standards. Most Georgia Standards of Excellence for math fit into this project as the equations can be any degree of difficulty the teacher requires to meet their curriculum.

Lesson Plan: Modular Origami

Math can also be incorporated less obviously, as done in the second lesson, by learning the technique of modular origami shown in detail in appendix B. Fractions and even some engineering principles are utilized as students use origami to discover how the different pieces of the paper sculpture fit together. Modular origami is different from traditional origami because it uses two or more sheets of paper folded the same way and then linking them together to create something larger. Repeating the same folds allows for modifications, such as making an assembly line where all the students link their individual pieces together, one after another, as the piece is passed down to the next person. This allows the entire class to create one large piece. Continuing the project through the year, students can keep adding to the origami piece as directed by the teacher.

Originating in Japan, origami encourages students to learn about a different culture. Patterns and repetition evolve as the students create the same shapes over and over. Students will view *Upstream* (2016) by Jeffery Gibson to discuss how shape and

symmetry are used in art. Gibson, being half Cherokee, was inspired by the geometric shapes and patterns used in Native American art to create this abstract painting.[29]

Modular origami lessons also allow students to practice the Four Cs. For critical thinking, students will be asking and solving questions such as "Should I start over or just re-fold?" Students will use problem-solving skills if their origami does not fit together correctly or look like the example. Communication can be used in discussion of their works, and by listening and responding as they are taught the modular origami process. If the teacher decides to use the assembly line modification, effective communication will be required as the students work together to create their larger work. Collaboration is important as students work together to make additions to the work throughout the year. Creativity is the most obvious, as the students will be doing hands-on work to create their own origami masterpieces and are encouraged to try making different origami creations.

Lesson Plan: Artificial Rainbows

Rainbows can be fascinating and students may find it exciting and intriguing to make their own. For this lesson plan, shown in detail in appendix C, the students will be using prisms, if available, or CDs to create their own rainbow. Utilizing a light source, such as a small LED flashlight, students will shine light on their prism or CD to create a rainbow reflected onto a blank sheet of paper. By painting over the rainbow in the correct colors, students can create their own abstract rainbow painting. Moving the light sources and prisms to different positions will create different shapes and patterns of rainbows to fill the whole page. Students will be encouraged to compare their work to an abstract

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[29] "Search the Collection," The Columbus Museum, http://www.columbusmuseum.com/collections/search/.

piece of art, such as the painting *Air View of Spring Nursery.* They will also discuss how the impressionists used light and color by viewing *Horseneck Falls* by John Henry Twatchman.

Air View of Spring Nursery (1966) is an abstract painting that is part of Thomas' series "Earth Paintings." This piece shows what a nursery of plants would look like when viewed from an airplane. Thomas was born in Columbus, Georgia and was the first African-American woman to have a solo exhibition at the Whitney Museum of American Art. Horseneck Brook was a real stream on Twatchman's farm that he would paint many times. For *Horseneck Falls (*c 1900), he painted the small waterfall the stream led to in the style of the Impressionists. He used color in an almost abstract way, along with quick brushstrokes, to give an "impression" of the waterfall he saw.[30]

The youngest students can use this as a tool to practice their motor skills while tracing the colors on the paper, as well as learn the colors themselves. Fourth through eighth grade students will learn about light refraction and color theory. Discussion of the pieces among the students improves their understanding of vocabulary by using the elemental and principal terms such as harmony, variety, and pattern. Creativity is abundant in this lesson as students can use the light to make their own unique creations. Students develop critical thinking skills as they think about how to create their rainbows and match the colors. If possible, the students can practice mixing colors to create the colors they need to match the ROYGBIV scheme. This lesson covers over 40 visual arts standards and three science standards.

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[30] "Search the Collection," The Columbus Museum, http://www.columbusmuseum.com/collections/search/.

Lesson Plan: Moon Dust Paint

Moon dust paint is the topic of the next lesson plan as shown in detail in appendix D. Utilizing chalk, glitter, and water, students create their own artwork inspired by outer space. The younger students will depict the phases of the moon, while the older students can create their own galaxy paintings. The ideas can be derived from their imagination or based on actual star charts. The paintings of the moon might be based on actual maps and include craters, riles, maria, or other features.

After viewing the painting *Ultra Deep Field* by Mia Rosenthal, students will be guided to discuss the piece using given elements and principles of art. Rosenthal drew inspiration from Hubble Space Telescope images for this drawing. Studying images of space for her work even inspired her to study particle physics and visit the European Organization for Nuclear Research in Switzerland.[31]

After viewing each other's works, they can participate in a simplified form of an art critique. This lesson encourages students to think about how science and art are related. Patterns and repetition are visible in the night sky just as color and variety are visible in a garden allowing nature to create its own works of art. This lesson covers over 50 visual art standards for grades K-8 and 7 science standards.

CONCLUSION

Incorporating these lesson plans fuses art and STEM to create a unique way of applying school standards in the classroom. As a future art historian and museum educator, I chose to focus on art, rather than the math or science. While STEM literature

[31] "Search the Collection," The Columbus Museum, http://www.columbusmuseum.com/collections/search/.

acknowledges the value of integrating art, many people seem to minimalize the importance of it. By creating lesson plans focusing on art, perhaps the plans will strengthen the importance of art as a valued discipline.[32]

Art education provides a mechanism for developing the creativity, communication, critical thinking and collaboration skills that students need to succeed in school and in the workplace, as outlined by the NEA's 21st Century Skills initiative. "By collaborating, rather than individualizing the projects, students bring together diverse life experiences, knowledge, and approaches to create and learn in an innovative framework."[33] Creativity and critical thinking can go hand-in-hand if they are developed and reinforced through continuing activities.[34] The arts can be used to incite critical inquiry into our beliefs about ourselves and our world.[35] One example of this is contemporary, interdisciplinary artist Natalie Jeremijenko. By using performance art and participative multimedia, she explores nonviolent, sociotechnical change and environment issues. Her work integrating biochemistry, physics, neuroscience, precision engineering, and art attests to the benefits of using STEAM.[36] The arts, coupled with

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[32] Nicola W. Sochacka, Kelly. W. Guyotte, and Joachim Walther. "Learning Together: A Collaborative Autoethnographic Exploration of STEAM (STEM + the Arts) Education." Journal Of Engineering Education 105, no. 1: 15-42. 2016. Education Full Text (H.W. Wilson), EBSCOhost, 2016.

[33] Kelly W. Guyotte, "Collaborative Creativity in STEAM: Narratives of Art Education Students' Experiences in Transdisciplinary Spaces."

[34] Ibid.

[35] Nicola W. Sochacka, Kelly. W. Guyotte, and Joachim Walther. "Learning Together: A Collaborative Autoethnographic Exploration of STEAM (STEM + the Arts) Education."

[36] Kelly W. Guyotte,, Nicki W. Sochacka, Tracie E. Costantino, Joachim Walther, and Nadia N. Kellam. "STEAM as Social Practice: Cultivating Creativity in Transdisciplinary Spaces."

STEM allows us to develop a better understanding of others and prepares us to become an active participant in changing the world in which we live.[37]

Those students who remain involved in the arts throughout adulthood are particularly likely to benefit from these activities. One way to remain engaged is through art museum education programs. Adding a creative aspect to STEM curriculum can help to make it less threatening to students like myself who struggle with math and science while still keeping it challenging.[38] Through STEAM, museum educators and lesson plans such as these are providing educators with the tools they need to engage their students in the arts and to prepare them for a bright future. STEAM prepares a way for both students and educators to assimilate science, technology, engineering, art and math in a way that impacts society, the environment, and our lives.[39]

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[37] Nicola W. Sochacka, Kelly. W. Guyotte, and Joachim Walther. "Learning Together: A Collaborative Autoethnographic Exploration of STEAM (STEM + the Arts) Education."
[38] Cassie F. Quigley, and Dani Herro. "Finding the Joy in the Unknown": Implementation of STEAM Teaching Practices in Middle School Science and Math Classrooms,"
[39] Nicola W. Sochacka, Kelly. W. Guyotte, and Joachim Walther. "Learning Together: A Collaborative Autoethnographic Exploration of STEAM (STEM + the Arts) Education." 2016.

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APPENDICES

APPENDIX A: COLOR BY NUMBER

Georgia Standards of Excellence

Visual Arts:
K5: VAK.CR.1, VAK.CR.2, VAK.CR.3 (a)(e), VAK.CR.5, VAK.PR.1, VAK.RE.1, VAK.CN.1 (a)(b), VAK.CN.3
1st Grade: VA1.CR.1 (a), VA1.CR.2, VA1.CR.3 (a), VA1.CR.5, VA1.PR.1, VA1.RE.1, VA1.CN.1 (a)(c), VA1.CN.3
2nd Grade: VA2.CR.1 (a), VA2.CE.2, VA2.CR.3 (a)(c)(d), VA2.CR.5, VA2.PR.1 (a), VA2.RE.1, VA2.CN.1 (a), VA2.CN.3
3rd Grade: VA3.CR.2, VA3.CR.3 (a), VA3.CR.5, VA3.PR.1, VA3.RE.1, VA3.CN.1 (a)(c), VA3.CN.2, VA3.CN.3
4th Grade: VA4.CR.1 (b), VA4.CR.2 (b), VA4.CR.5, VA4.PR.1, VA4.RE.1, VA4.CN.1 (a)(c), VA4.CN.2, VA4.CN.3
5th Grade: VA5.CR.1 (a)(b), VA5.CR.2 (a), VA5.CR.3 (a), VA5.CR.5, VA5.PR.1 (a), VA5.PR.2, VA5.RE.1, VA5CN.1 (a)(c), VA5.CN.3, VA6.CR.2 (a)(d)
6th Grade: VA6.CR.3, VA6.CR.5, VA6.RE.2
7th Grade: VA7.CR.2, VA7.CR.3, VA7.RE.2, VA7.CN.1
8th Grade: VA8.CR.1 (a), VA8.CR.2 (a), VA8.CR.3
High school: VAHSVA.CR.3, VAHSVA.CN.2, VAHSVA.NC.3

*Math:
K5: MGSEK.OA.3, MGSEK.OA.5,
1st Grade: MGSE1.OA.8, MGSE1.NBT.3
2nd Grade: MGES2.OA.2, MGSE2.NBT.4, MGSE2.NBT.5, MGSE2.NBT.6, MGSE2.NBT.8, MGSE2.G.2
3rd Grade: MGSE.3.OA.4, MGSE3.OA.5, MGSE3.OA.6, MGSE3.OA.7, MGSE3.NBT.3 4th Grade: MGSE4.NBT.2, MGSE4.NBT.4

*Math standards depend on the equations chosen

Standard Examples – 1st Grade:
VA1.CR.1 Engage in the creative process to generate and visualize ideas by using subject matter and symbols to communicate meaning.

a. Generate individual and group ideas in response to visual images and personal experiences.

VA1.CR.2 Create works of art based on selected themes.

a. Create works of art emphasizing one or more elements of art and/or principles of design.

b. Create works of art that attempt to fill the space in an art composition.

VA1.CR.3 Understand and apply media, techniques, and processes of two-dimensional art.

VA1.CR.5 Demonstrate an understanding of the safe and appropriate use of materials, tools, and equipment for a variety of artistic processes.
VA1.PR.1 Participate in appropriate exhibition(s) of works of art to develop identity of self as artist.

a. Complete works of art.

b. Sign a finished work of art.

VA1.RE.1 Discuss personal works of art and the artwork of others to enhance visual literacy.

a. Use a variety of strategies for art criticism.

b. Explain how selected elements of art are used in works of art to convey meaning.

c. Demonstrate an appreciation for art and art making processes by communicating thoughts and feelings.

VA1.CN.1 Investigate and discover the personal relationships of artists to community, culture, and the world through making and studying art.

a. Recognize the unique contributions of contemporary and/or historical art forms, including Georgia artists.

c. Recognize ways that artists are involved in communities and careers (e.g. architects, painters, photographers, interior designers, educators, museum educators).

VA1.CN.3 Develop life skills through the study and production of art (e.g. collaboration, creativity, critical thinking, communication).
MGSE1.OA.8 Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations $8 + ? = 11$, $5 = _ - 3$, $6 + 6 = _$.
MGSE1.NBT.3 Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and

Goal: Students will practice their math skills in a hands-on activity utilizing paint chips and paintings from the Columbus Museum's permanent collection. They will also discuss the elements and principles of art in relation to the pieces.

Materials:

- Grid version of selected painting
  - Instructions can be found at http://www.nathangibbs.com/2009/02/24/art-education-lesson-on-identity-using-color-swatches/
- Blank grid template with math expression (or just numbers for younger students)
- Paint chips (with numbers associated with them)
- Glue sticks

Prior to Activity: Discussion of the following topics with your students will help them to better understand the concepts behind the activity

- Math expressions used (depends on grade level curriculum)
- Elements and principles of design in relation to the pieces they are recreating
- The options include:

1st- 3rd Grade Option

Air View of Spring Nursery
by Alma Thomas

4th-8th Grade Option

Fergus, Boy in Blue
by Robert Henri

9th-12th Grade Option

What's different about Alice is that she has the most incisive way of telling the truth
by Amy Sherald

- These pieces are both portraits or paintings of people
    - How are these portraits different? How are they similar?
- What colors do you see?
- What elements and principles are being used in these paintings? How?
- What ways might math have been used to create these pieces?
    - Some possible answers may include: measuring facial features, finding the center of the canvas, to create correct proportions, to create symmetry (these are asymmetrical), using basic shapes to create sketches

Activity Procedure:

- Students will first solve the equations in each blank grid space
- Once solved, they will match their answer with the paint chip labeled with that number
    - For example, if their answer is 9 they will take the green paint chip labeled "9"
- They will take the chosen paint chip and place it on the grid in the space of the solved equation
    - Student may want to wait until they are completely finished to glue the paint chips to the paper in case of miscalculations
- They will continue until all of the grid spaces are solved and proceed to fill each grid with the assigned paint chip
- Once completed, their grids should resemble a pixilated version of the original painting

Post-Activity:

- Has the painting changed at all? How is it the same?
- What was the emphasis in the original painting? What is emphasized now?
- Did any other elements or principles change? Which ones and how?
- How else do you think math is used in art?

- Do math and art have anything in common (such as patterns, balance, repetition, etc)?

Elements of Art

Texture – Tactile texture can be touched; visual texture can be seen
Line – A mark that moves across a space or surface. It can be horizontal, vertical, or diagonal
Color – Color can be used to decorate, show emotion, or be symbolic
Shape – 2D (height x width)
Form – 3D (height x width x depth)
Value – Lightness or darkness of color; Tones, shades, or gradations
Space – We move through 3D space. We draw or paint on 2D space to represent 3D space

Principles of Design

Balance – Formal: symmetrical or informal: asymmetrical, can be radial or approximate
Proportion – The relationship of size or distance from one object to another
Harmony – Using similar lines, shapes, colors, or texture
Unity – The feeling of wholeness. Using one color creates unity
Variety – using different lines, shapes, color, or texture
Emphasis – One specific area or object that directs or draws the views attention
Movement – The illusion of motion with shape or contour in 2D space, or actual 3D movement
Repetition – Using the same shape/color more than one time
Pattern – Repeating sequence of shapes/colors, the same of different sizes
Rhythm – Regular or harmonious pattern of shapes/colors or sounds "Working together"

APPENDIX B: MODULAR ORIGAMI - PAPER STARS

Georgia Standards of Excellence

Visual Arts:
1st Grade: VA1.CR.4 (c), VA1.CR.5, VA1.PR.1, VA1.CN.1 (a), VA1.CN.3
2nd Grade: VA2.CR.2 (b), VA2.CR.4 (a), VA2.CR.5, VA2.RE.1 (a)(c)(d), VA2.CN.1 (a), VA2.CN.3
3rd Grade:VA3.CR.2 (b), VA3.CR.4 (a), VA3.CR.5, VA3.RE.1 (b)(c)(d), VA3.CN.1 (a), VA3.CN.2, VA3.CN.3
4th Grade: VA4.CR.2 (b), VA4.CR.4 (b), VA4.CR.5, VA4.RE.1 (c)(d), VA4.CN.1 (a), VA4.CN.2 (b), VA4.CN.3,
5th Grade: VA5.CR.2 (b), VA5.CR.4 (b), VA5.CR.5, VA5.RE.1, VA5.CN.1 (a), VA5.CN.3
6th Grade: VA6.CR.3, VA6.CR.5, VA6.RE.2, VA6.CN.1 (c), VA6.CN.3 (c)
7th Grade: VA7.CR.3, VA7.CR.4 (a)(b), VA7.CR.5, VA7.RE.2, VA7.CN.3 (c)
8th Grade: VA8.CR.3, VA8.CR.4 (a)(b), VA8.CR.5, VA8.RE.2, VA8.CN.1 (c) VA8.CN.3 (c)

Math:
1st Grade: MGSE1.G.1, MGSE1.G.2, MSGE1.G.3
2nd Grade: MGSE2.G.1, MGSE2.G.3
3rd Grade:MGSE3.G.1, MGSE3.G.2
5th Grade: MGSE5.G.3, MGSE5.G.4
7th Grade: MGSE7.G.2

Standard Examples – 5th Grade:

VA5.CR.2 Create works of art based on selected themes.
b. Create works of art emphasizing multiple elements of art and/or principles of design.
VA5.CR.4 Understand and apply media, techniques, processes, and concepts of three-dimensional works of art
b. Create sculpture that demonstrates a design concept using a variety of methods (e.g. papier-mâché, paper sculpture, assemblage, found object sculpture).
VA5.CR.5 Demonstrate an understanding of the safe and appropriate use of materials, tools, and equipment for a variety of artistic processes.
VA5.RE.1 Use a variety of approaches for art criticism and to critique personal works of art and the artwork of others to enhance visual literacy.
a. Interpret and evaluate works of art through thoughtful discussion and speculation about the mood, theme, and intentions of those who create works of art.
b. Explain how selected elements and principles of design are used in works of art to convey meaning.

c. Use a variety of approaches to engage in verbal and/or written art criticism. d. Use a variety of strategies to critique, discuss, and reflect on personal works of art and the work of peers.

VA5.CN.1 Investigate and discover the personal relationships of artists to community, culture, and the world through making and studying art.

a. Recognize the unique contributions of contemporary and/or historical art forms, including Georgia artists.

VA5.CN.3 Develop life skills through the study and production of art (e.g. collaboration, creativity, critical thinking, communication).

MGSE5.G.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles

MGSE5.G.4 Classify two-dimensional figures in a hierarchy based on properties (polygons, triangles, and quadrilaterals).

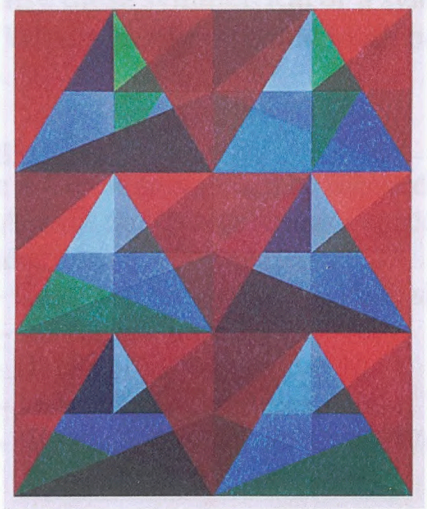
Goal: Students will create their own piece of modular origami while discussing how it relates to math and the elements and principles of design

Materials:

- Variety of colored origami paper

Prior to Activity: Discussion of some of the following ideas will help students to better understand concepts behind the activity

- Modular Origami – creating one shape over and over then putting the pieces together to create a larger form
- Discuss shapes such as parallelograms
- What elements and principles are used to create modular origami (such as repetition, pattern, form, etc.)? How?
- Discussion of *Upstream* by Jeffery Gibson will help students to better understand the elements and principles of design



  - How does this piece show pattern or repetition? What elements help to create the pattern?
  - Does it have shape or form? Or both?
  - What shapes do you see?
  - Is this piece symmetrical? Or asymmetrical?

Activity Procedure:

- Give each student 8 pieces of origami paper (the colors do not matter)
- Create 8 parallelograms
  1. Fold paper in half. Open and repeat fold so white side of paper is showing.
  2. With paper oriented vertically, and open side on the right, bring bottom left corner to right hand edge. Crease well.
  3. Open paper with colored side facing down.
  4. Fold top two corners to middle crease. Crease well.

5. Fold paper in half (*repeating step 1*)
6. Push the center of the bottom edge up. The creases you made in step 2 will collapse between the sides.

- *Gently* push and pull the pieces to turn the star into a circle and vice versa
  - Encourage students to see what other shapes they can make

***TIP:** The instructions above can be found on whatdowedoallday.com. To watch the stars being made, use this link: https://www.youtube.com/watch?time_continue=69&v=p8QSMzgnLf0

Post-Activity:

- How does creating these paper stars relate to math?
- Why is this shape a parallelogram?
  - What shapes does it change into as you fold?
- Are these symmetrical or a symmetrical?
- What other ways could math be used in art?

Elements of Art

Texture – Tactile texture can be touched; visual texture can be seen
Line – A mark that moves across a space or surface. It can be horizontal, vertical, or diagonal
Color – Color can be used to decorate, show emotion, or be symbolic
Shape – 2D (height x width)
Form – 3D (height x width x depth)
Value – Lightness or darkness of color; Tones, shades, or gradations
Space – We move through 3D space. We draw or paint on 2D space to represent 3D space

Principles of Design

Balance – Formal: symmetrical or informal: asymmetrical, can be radial or approximate
Proportion – The relationship of size or distance from one object to another
Harmony – Using similar lines, shapes, colors, or texture
Unity – The feeling of wholeness. Using one color creates unity
Variety – using different lines, shapes, color, or texture
Emphasis – One specific area or object that directs or draws the views attention
Movement – The illusion of motion with shape or contour in 2D space, or actual 3D movement
Repetition – Using the same shape/color more than one time
Pattern – Repeating sequence of shapes/colors, the same of different sizes
Rhythm – Regular or harmonious pattern of shapes/colors or sounds "Working together"

*Origami instructions adapted from: https://www.whatdowedoallday.com/transforming-ninja-star/

APPENDIX C: ARTICFICAL RAINBOW

Georgia Standards of Excellence

Visual Arts:
K5: VAK.CR.1, VAK.CR.2 (a), VAK.CR.3 (a)(c)(d)(e), VAK.CR.5, VAK.PR.1,VAK.RE.1, VAK.CN.1 (a)(b), VAK.CN.3
1st Grade: VA1.CR.2, VA1.CR.3 (a)(d), VA1.CR.5, VA1.PR.1, VA1.CN.1 (a)VA1.CN.3,
2nd Grade: VA2.CR.2 (b), VA2.CR.3 (a)(c)(d), VA2.CR.5, VA2.PR.1M VA2.RE.1, VA2.CN.1 (a), VA2.CN.3
3rd Grade: VA3.CR.2, VA3.CR.3 (a)(d), VA3.CR.5, VA3.RE.1, VA3.CN.1 (a), VA3.CN.2, VA3.CN.3
4th Grade: VA4.CR.2 (b), VA4.CR.3 (a)(c)(d), VA4.CR.5, VA4.RE.1, VA4.CN.1 (a), VA4.CN.2 (a), VA4.CN.3
5th Grade: VA5.CR.2 (a)(b), VA5.CR.3 (a)(c)(d), VA5.CR.5, VA5.PR.2, VA5.RE.1 (c)(d), VA5.CN.1 (a), VA5.CN.3
6th Grade: VA6.CR.1 (a)(c)(d), VA6.CR.2 (a)(c)(d), VA6.CR.3, VA6.CR.4, VA6.CR.5, VA6.PR.1, VA6.RE.2, VA6.RE.3, VA6.CN.1 (c), VA6.CN.2, VA6.CN.3 (c)
7th Grade: VA7.CR.1 (a)(c), VA7.CR.2 (a)(c)(d), VA7.CR.3, VA7.CR.4, VA7.CR.5, VA7.CR.6, VA7.PR.1, VA7.RE.2, VA7.RE.3, VA7.CN.1 (c), VA7.CN.2, VA7.CN.3 (c)
8th Grade: VA8.CR.1 (a)(c)(d), VA8.CR.2 (a)(c), VA8.CR.3, VA8.CR.4, VA8.CR.5, VA8.PR.1, VA8.RE.2, VA8.RE.3, VA8.CN.2 (a), VA8.CN.3 (c)

Science:
1st Grade: S1P1 (a)(b)(c)
4th Grade: S4P1 (b)(c)
8th Grade: S8P4 (d)

Standard Examples – 4th Grade:
VA4.CR.2 Create works of art based on selected themes
b. Create works of art emphasizing multiple elements of art and/or principles of design.
VA4.CR.3 Understand and apply media, techniques, processes, and concepts of two dimensional art.
a. Apply drawing and painting techniques with a variety of media (e.g. pencil, crayon, pastel, charcoal, tempera, watercolor, acrylic).
c. Combine materials in creative ways to make works of art (e.g. mixed-media, collage, available technology).
d. Apply understanding of multiple color schemes to create works of art (e.g. monochromatic, analogous, neutral, complementary).
VA4.CR.5 Demonstrate an understanding of the safe and appropriate use of materials, tools, and equipment for a variety of artistic processes.
VA4.RE.1 Use a variety of approaches for art criticism and to critique personal works of art and the artwork of others to enhance visual literacy.

a. Interpret and evaluate works of art through thoughtful discussion and speculation about the mood, theme, and intentions of those who created a work of art.

b. Explain how selected elements and principles of design are used in works of art to convey meaning.

c. Use a variety of approaches to engage in verbal and/or written art criticism.

d. Use a variety of strategies to critique, discuss, and reflect on personal works of art and the work of peers.

VA4.CN.1 Investigate and discover the personal relationships of artists to community, culture, and the world through making and studying art.

a. Recognize the unique contributions of contemporary and/or historical art forms, including Georgia artists.

VA4.CN.2 Integrate information from other disciplines to enhance the understanding and production of works of art.

b. Apply art skills and knowledge to improve understanding in other disciplines.

VA4.CN.3 Develop life skills through the study and production of art (e.g. collaboration, creativity, critical thinking, communication).

S4P1 Obtain, evaluate, and communicate information about the nature of light and how light interacts with objects.

b. Plan and carry out investigations to describe the path light travels from a light source to a mirror and how it is reflected by the mirror using different angles.

c. Plan and carry out an investigation utilizing everyday materials to explore examples of when light is refracted. (Clarification statement: Everyday materials could include prisms, eyeglasses, and a glass of water.)

Goal: Students will learn basic concepts of light refraction and color theory through a hands-on activity utilizing paint and light. Students will examine examples from the Columbus Museum's permanent collection to learn how light and color are used in art.

Materials:

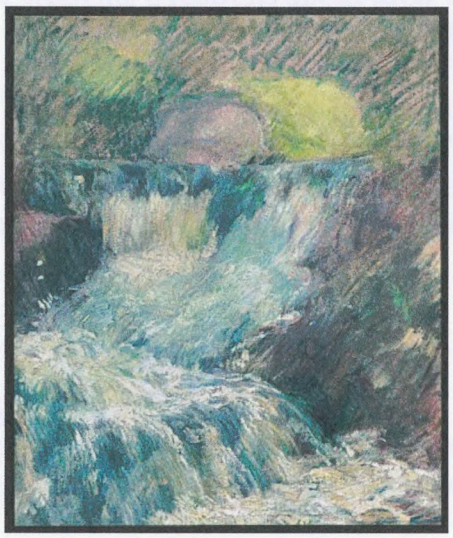
- Small LED flashlight
- CD
- Paper (2 sheets)
- Washable Paint
- Paintbrushes
- Scissors

Prior to Activity: Discussion of some of the following will help students to better understand concepts behind the activity

- Discuss how rainbows (colors) are created by light refracting
  - Let the students use the flashlights and CDs to discover how to create a rainbow
  - Encourage them to try different angles and distances to form their rainbows
- Discuss color and value in the context of the elements of design. How do color and value help create the principles of design (such as harmony, variety, pattern, etc)?
  - Use *Air View of Spring Nursery* by Alma Thomas, from the Columbus Museum's permanent collection, as an example to support the discussion

    - What principles of design does color support in this piece? How so?
    - What colors are used?
    - What do you think this is a painting of?
    - It is an abstract painting, meaning it does not realistically depict the subject. It is actually what Thomas thinks rows of flowers and plants would look like if viewed from an airplane. Can you see the flowers?

- Use *Horseneck Falls* by John Henry Twatchman, from the Columbus Musuem's permanent collection, as an example to support the discussion



  - Is color used realistically in this painting? Why or why not?
  - What colors do you see in the waterfall?
  - This piece is an example of Impressionism. The Impressionists used quick brushstrokes and colors to give an "impression" of what they were painting. They wanted to capture the natural light and how it affected the scene.
  - As you get farther away from the piece, does the subject become clearer?

Activity Procedure:

- Shine the flashlight onto the back of the CD to create a rainbow
- Move the CD and flashlight to reflect the rainbow onto the paper
- Paint over the rainbow
  - Students may need a partner to hold the flashlight while they paint

***Modifications for older students:**

- Trace the CD on a separate sheet of paper and cut out a circle the size of the CD
- Fold the cutout circle in half or fourths and cut out small shapes to create a paper snowflake
- Unfold the circle and place it on top of the CD, this will create more intricate patterns for the students to paint in their rainbow
- Let students mix their own paint colors

Post-Activity:

- Sign the bottom corner or back of the piece

- Have students walk around and view each other's paintings
- Allow students to show their "paper snowflake" (if applicable) to see how their patterns effected the light
- Ask the students questions about their work as a simpler version of a critique
    - How are your pieces different? How are they the same?
    - What principles and elements of design were used? How?
    - What would you change about your piece?
- Are your paintings abstract or realistic? How?
- Are your paintings Impressionistic in anyway? Why or why not?
- Do you think art can be found in science and the natural world? Where and how?

Elements of Art

Texture – Tactile texture can be touched; visual texture can be seen
Line – A mark that moves across a space or surface. It can be horizontal, vertical, or diagonal
Color – Color can be used to decorate, show emotion, or be symbolic
Shape – 2D (height x width)
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Balance – Formal: symmetrical or informal: asymmetrical, can be radial or approximate
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Variety – using different lines, shapes, color, or texture
Emphasis – One specific area or object that directs or draws the views attention
Movement – The illusion of motion with shape or contour in 2D space, or actual 3D movement
Repetition – Using the same shape/color more than one time
Pattern – Repeating sequence of shapes/colors, the same of different sizes
Rhythm – Regular or harmonious pattern of shapes/colors or sounds "Working together"

APPENDIX D: MOON DUST GALAXY PAINTING

Georgia Standards of Excellence

Visual Arts:
K5: VAK.CR.1, VAK.CR.2, VAK.CR.3 (a)(e), VAK.CR.5, VAK.PR.1, VAK.RE.1, VAK.CN.1 (a)(b), VAK.CN.3
1st Grade: VA1.CR.1 (a), VA1.CR.2, VA1.CR3 (a), VA1.CR.5, VA1.PR.1, VA1.RE.1, VA1.CN.1 (a)(e), VA1.CN.3,
2nd Grade: VA2.CR.1 (a), VA2.CE.2, VA2.CR.3 (a)(c)(d), VA2.CR.5, VA2.PR.1 (a), VA2.RE.1, VA2.CN.1 (a), VA2.CN.3
3rd Grade: VA3.CR.2, VA3.CR.3 (a), VA3.CR.5, VA3.PR.1, VA3.RE.1, VA3.CN.1 (a)(c), VA3.CN.2, VA3.CN.3
4th Grade: VA4.CR.1 (b), VA4.CR.2 (b), VA4.CR.5, VA4.PR.1, VA4.RE.1, VA4.CN.1 (a), VA4.CN.2 (b), VA4.CN.3
5th Grade: VA5.CR.1, VA5.CR.2 (b), VA5.CR.3 (a), VA5.CR.5, VA5.PR.1, VA5.PR.2, VA5.RE.1, VA5CN.1 (a), VA5.CN.3
6th Grade: VA6.CR.1, VA6.CR.2 (a)(b), VA6.CR.3, VA6.CR.4(a), VA6.CR.5, VA6.CR.6, VA6.PR.1, VA6.RE.2, VA6.RE.3
7th Grade: VA7.CR.1, VA7.CR.2 (a)(d), VA7.CR.3, VA7.CR.4, VA7.CR.5, VA7.CR.6, VA7.PR.1, VA7.RE.2, VA7.RE.3, VA7.CN.1
8th Grade: VA8.CR.1, VA8.CR.2 (a)(b), VA8.CR.3, VA8.CR.4 (a), VA8.CR.5, VA8.CR.6, VA8.PR.1, VA8.RE.2, VA8.RE.3, VA8.CN.3

Science:
2nd Grade: S2E1, S2E2 (d)
4th Grade: S4E1, S4E2 (b)
6th Grade: S6E1, S6E2

Example Standards – 4th Grade:
VA4.CR.1 Engage in the creative process to generate and visualize ideas by using subject matter and symbols to communicate meaning.

b. Apply available resources, tools, and technologies to investigate personal ideas through the process of making works of art.

VA4.CR.2 Create works of art based on selected themes.

b. Create works of art emphasizing multiple elements of art and/or principles of design.

VA4.CR.5 Demonstrate an understanding of the safe and appropriate use of materials, tools, and equipment for a variety of artistic processes.

VA4.PR.1 Plan and participate in appropriate exhibition(s) of works of art to develop identity of self as artist.

a. Prepare works of art for exhibition with signature, title, and/or artist statement on finished work.

b. Choose works of art to be displayed based on thoughtful reflection.

VA4.RE.1 Use a variety of approaches for art criticism and to critique personal works of art and the artwork of others to enhance visual literacy.

a. Interpret and evaluate works of art through thoughtful discussion and speculation about the mood, theme, and intentions of those who created a work of art.

b. Explain how selected elements and principles of design are used in works of art to convey meaning.

c. Use a variety of approaches to engage in verbal and/or written art criticism.

d. Use a variety of strategies to critique, discuss, and reflect on personal works of art and the work of peers.

VA4.CN.1 Investigate and discover the personal relationships of artists to community, culture, and the world through making and studying art.

a. Recognize the unique contributions of contemporary and/or historical art forms, including Georgia artists.

VA4.CN.2 Integrate information from other disciplines to enhance the understanding and production of works of art.

b. Apply art skills and knowledge to improve understanding in other disciplines.

VA4.CN.3 Develop life skills through the study and production of art (e.g. collaboration, creativity, critical thinking, communication).

S4E1 Obtain, evaluate, and communicate information to compare and contrast the physical attributes of stars and planets.

a. Ask questions to compare and contrast technological advances that have changed the amount and type of information on distant objects in the sky.

b. Construct an argument on why some stars (including the Earth's sun) appear to be larger or brighter than others. (Clarification statement: Differences are limited to distance and size, not age or stage of evolution.)

c. Construct an explanation of the differences between stars and planets.

d. Evaluate strengths and limitations of models of our solar system in describing relative size, order, appearance and composition of planets and the sun. (Clarification statement: Composition of planets is limited to rocky vs. gaseous.)

S4E2 Obtain, evaluate, and communicate information to model the effects of the position and motion of the Earth and the moon in relation to the sun as observed from the Earth.

b. Develop a model based on observations to describe the repeating pattern of the phases of the moon (new, crescent, quarter, gibbous, and full).

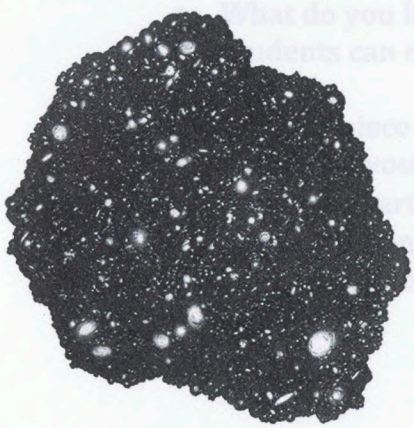
Goal: Students will study the phases of the moon and what makes up a galaxy through a hands-on activity utilizing homemade paint. Students will examine examples from the Columbus Museum's permanent collection to learn how art and science intertwine.

Materials:

- Gray/Black Chalk
- Water
- Fine Glitter (Glow in the Dark Optional)
- Thick Black Paper
- Paintbrush
- Q-Tips
- White crayon

Prior to Activity: Discussion of some of the following topics will help students to better understand concepts behind the activity

- For elementary students, discuss the phases of the moon and what they look like
- For junior high and high school students, discuss what makes up a galaxy and view star charts
- Discuss the elements and principles of design so students may use them to discuss their art and other's
- Use, Mia Rosenthal's *Ultra Deep Field*, from the Columbus Museum's collection, as an example to support the discussion for all grades



- What do you think was the inspiration for this piece?
  - Rosenthal was inspired by Hubble Space Telescope images
- Is this an accurate representation of outer space?
- What elements or principles of design are used? How?

Creating Moon Dust Paint:

- Break chalk into small pieces and grind up to create chalk dust
  - The dust shouldn't be completely fine
- Take a <u>small</u> amount of water and add to the chalk dust

    - The amount of water depends on the amount of chalk, but it should look like chunky paint
    - The paint should still contain small chunks of chalk dust
- After the water and chalk have been mixed, add the glitter and mix well

Activity Procedure (Elementary Students):

- Use the Moon Dust Paint to depict the different phases of the moon
- Underneath each moon, write the name of the phase in white crayon
- Students may also look at detailed pictures of the moon to create accurate pictures with craters, rilles, etc.

Activity Procedure (Junior High and High School Students):

- Allow the students to view star charts for inspiration as well as *Ultra Deep Field*
- Students can create the Moon Dust paint using the instructions above
- Use the paint to create your own galaxy scene
    - Can be based on the star charts or from your own imagination

***TIP**: Q-tips can be used instead of a paintbrush to create smaller, more even stars

Post-Activity:

- Sign the bottom corner or back of painting
- Students can participate in a simpler version of a critique
    - Encourage students to walk around and view each other's pieces
        - What makes them different? The same?
        - What do you like about others' pieces?
        - Students can explain their galaxy and artistic process if they wish
    - How does your piece use the elements and principles of design?
    - Is there anything you would change or add to your painting?
- Do you think science and art can be used together?
- Do you think art can be found in scientific process and natural occurrences (such as galaxies, planets, etc)? How so?

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*Moon Dust Paint instructions adapted from: https://www.bloglovin.com/blogs/learn-play-imagine-8743965/moon-dust-paint-recipe-2863584779

LESSON PLANS INTEGRATING ART WITH STEAM: PROVIDING STUDENTS WITH UNIVERSAL EDUCATION EXPERIENCE

A thesis submitted to the College of the Arts in partial fulfillment of the requirements for the degree of

BACHELOR OF ARTS

DEPARTMENT OF ART HISTORY

by

Karolyn L. Turner

2017

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